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ABSTRACT

The pre- and posttestings of 30 emotionally disturbed children (median age 10.3 years) provided with short term residential services (median stay 8.2 months) in a mental health facility were evaluated to determine if there were a significant time rate of change in mastery learning and if the significant factors could be identified. The test battery included the Wechsler Intelligence Scale for Children, the Wide Range Achievement Test, the Illinois Test of Psycholinguistic Abilities, and the Gray Oral Reading Test. Results indicated that time on-task, on-task concentration, and short term memory were significantly related to undergirding capabilities and skills required for mastery learning; and that Ss made greater than expected academic gains. (DB)

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INDICATED UNDERGIRDINGS OF MASTERY LEARNING

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The pre- and post testings of 30 short term institutionalized children were evaluated to determine a) if there was a significant time rate of change in mastery learning; b) if the significant factors could be pin-pointed; and c) if the significant contributing factors could be surfaced. Results indicated that 1) time on-task, 2) on-task concentration and 3) short term memory are significantly related to undergirding capabilities and skills required for mastery learning.

The purpose of this study was to evaluate the effectiveness of a short-term residential children's school program in a mental health facility. To evaluate the effectiveness it was necessary to ask the following questions: 1) Is there a time rate of change in the mastery learning?; 2) Can specific gains be pinpointed?; 3) How significant are the gains?; 4) Can variables or parameters be singled out as contributing factors of the gain ratio?; 5) Are the gains related significantly to mastery learning?

POPULATION

The population for this study was drawn from the full time resident school children of the Adler Center located in Champaign, Illinois. The Center is one of several Illinois' Department of Mental Health and Developmental Disabilities short term (usually not exceeding 1 year) mental health facilities designed for children up to the age of 13 years, who are in need of mental health services because of mental, or emotional and/or school related acting out behavioral problems. The school population for this study consisted of 30 full time school children who had utilized the facility and were again back in their own community; ages between 5.8 years to 13.6 years (median 10.3 years); I.Q. range from 72 to 134 (median I.Q. 98); length of stay 5 to 13 months (median 8.2 months).

SOURCE OF DATA

Each child, prior to being accepted in the school program, is evaluated by a battery of tests administered by a Diagnostician-Educator who is also a certified school psychologist who evaluates the child's potential, capabilities and skills so that an individualized prescriptive

program can be initiated for that child. Also, just prior to discharge, a similar battery is given. The final battery will give an indication of area achievements or gains and will be used to index the grade level to which the child will return to in his community. The basic school data analyzed for this study included the pre- and post testings of the 1) Wechsler Intelligence Scale for Children, (1949); 2) the Wide Range Achievement Test (1965); 3) Illinois Test of Psycholinguistic Abilities (1961); and 4) Gray Oral Reading Test (1967).

STATISTICS USED

1) The raw data comprised all subtests of the initial intake testings of the WISC, ITPA, WRAT and Gray Oral Reading Test and these were compared to discharge findings of the same battery of tests. The differences (gains) were then divided by the length of time the individual child had been in full time residence. The resultants were monthly gains ratios or a time rate of change in each specific area evaluated.

2) Since greater than anticipated gains were achieved, a t test for significance of means was utilized.

3) To surface the significant correlated variables, a stepwise multiple correlation together with a stepwise multiple regression of all variables (65) was employed. Four of the 65 variables were selected as dependent variables: (1) the reading gains from entry to discharge; (2) the arithmetic gains from entry to discharge; (3) the spelling gains from entry to discharge and (4) the length of residential stay time.

FUNCTIONAL AGE In this study, functional ages are used consistently rather than weighted scores. Functional age may be defined as that age when the organism is able to function comfortably with a reasonable amount of accuracy. The functional age derivatives for the WISC are to be found in Appendix E of the Manual. The ITPA functional age equivalents are to be found in the Examiner's Manual. Table 1.

WISC ORGANIZATIONAL AREAS

Areas	Subtests
Conceptual-verbal comprehension	Information, Comprehension Similarities and Vocabulary
Spatial Organizing ability	Picture Completion, Block Design and Object Assembly
Sequencing organizing ability	Coding, Digit Span and Picture Arrangement
Attention-ability	Arithmetic and Digit Span

The above Organizational areas, with the exception of Attention-ability are organized according to categories suggested by Bannatyne (1968, 1971). The Attention-ability area is based on the 'distractability' studies of Bortner& Birch (1962) and Baumeister & Bartlett (1962).

RAW SCORES AND DEVELOPMENT OF MONTHLY RATIO GAINS The time factor for the individual child's residence varies. This study compared the intake testings with that of discharge testings and compared this to the number of months the child had been in residence. Utilizing this methodology, the average gain per length of unit time can be computed on a monthly ratio basis. The following table is a ranking order of the subtests of the WISC, ITPA, WRAT and the Gray Oral based on the pre- and post testings.

TABLE 1

RANKING ORDER OF MONTHLY RATIO GAINS

SUBTESTS	GAIN/MONTH
Picture Arrangement	2.88:1
Digit Span (short term memory)	2.81:1
Spatial Organization Ability	2.55:1
Comprehension	2.39:1
Similarities	2.28:1
Sequential Organization Ability	2.28:1
Verbal Expression	2.28:1
Conceptual-verbal Comprehension	2.27:1
Grammatic Closure	2.27:1
Auditory Association	2.21:1
Picture Completion	2.19:1
Information	2.14:1
Attention-Ability	2.13:1
Block Design	2.11:1
Auditory Sequential Memory	2.07:1
Coding	2.02:1
Object Assembly	1.89:1
Arithmetic (WISC)	1.85:1
Visual Reception	1.80:1
Vocabulary (WISC)	1.67:1
Visual Association	1.60:1
Visual Closure	1.60:1
Visual Sequential Memory	1.50:1
Auditory Reception	1.43:1
Manual Expression	1.08:1
RESULTANTS (Classroom Academics)	
Spelling	1.86:1
Vernacular Vocabulary	1.81:1
Arithmetic	1.77:1
Reading	1.67:1
Performance I.Q. (Performance MA)	1.39:1
Verbal I.Q. (Verbal MA)	1.16:1
Full Scale I.Q.	1.29:1

It is to be noted that the ratio of gains exceeded the expected 1:1 ratio (one month learning gain for each month of residence). The raw scores would indicate that since the gains were greater than 1:1, that it would be necessary to determine the significance of the gains. Therefore, a t test for significance was used. The t test produced the following results.

TABLE 2

PAIRED t TESTS OF INTAKE AND DISCHARGE WISC AND ITPA SUBTESTS

WISC Subtests	t-value	ITPA Subtests	t-value
Verbal I.Q.	3.531	Visual Reception	3.241
Performance I.Q.	4.102	Auditory Reception	3.336
Full Scale I.Q.	4.386	Visual Association	2.821
Information	6.236	Auditory Association	4.539
Comprehension	4.388	Visual Sequential Memory	2.472
Similarities	3.297	Auditory Sequential Memory	3.047
Vocabulary	4.823	Verbal Expression	6.786
Picture Completion	4.146	Manual Expression	1.665
Picture Arrangement	3.590	Visual Closure	2.619
Block Design	4.731	Grammatic Closure	2.917
Object Assembly	3.170	Visual Skills Composite	8.171
Coding	2.74	Auditory Skills Composite	4.248
Digit Span	4.469		
Arithmetic	3.787		
Conceptual Age	6.871		
Spatial Organizing Ability Age	5.459		
Sequential Organizing Ability Age	6.295		
Attention-Ability	3.392		

t value = 2.750 @ .01 level
t value = 2.045 @ .05 level

It is to be noted that with the exception of the subtest Manual Expression (t value = 1.665) the subtests showed significance at the .05 and/or .01 levels. An analysis of the above indicated that specific categories had been identified. These categories (requisites for learning) include capabilities, the acquisition of undergirding skills and attending to task.

TABLE 3

PAIRED t TEST OF SIGNIFICANT AREA GAINS BETWEEN INTAKE AND DISCHARGE TESTINGS

Capabilities	t value
Conceptual Age (verbal comprehension)	6.871
Spatial Organizing Ability Age	5.459
Sequential Organizing Ability Age	6.295
Undergirding Skills	
Visual skills composite (visual reception, visual association, visual sequencing memory)	8.171
Auditory skills composite (auditory reception, auditory association, auditory sequencing memory)	4.248
Attention-ability (on-task concentration + short term memory)	3.397
I.Q. Index	
Verbal I.Q.	3.531
Performance I.Q.	4.102
Full Scale I.Q.	4.386

t value = 2.765 @ .01 level

In the above table, the I.Q. index is presented because the I.Q. index is the accepted indicator for the three academic categories of capabilities, skills and on-task ability. It is to be noted that each category is highly significant beyond the .01 level.

Since the variable of attention is the combination of on task concentration (arithmetic) and short term memory (digit span) the following table of r values is offered.

TABLE 4

Correlation of on-task concentration (Arithmetic) and short term memory (Digit Span) with (1) Capabilities and (2) Undergirding Skills.

Arithmetic:	r value
Conceptual age (verbal comprehension)	.8484
Spatial organizing ability age	.7661
Sequential organizing ability age	.9170
Auditory skills composite (reception, association, sequencing)	.6524
Visual skills composite (reception, association, sequencing)	.6096
Digit Span:	
Conceptual age (verbal comprehension)	.8140
Spatial organizing ability age	.7149
Sequencing organizing ability age	.8858
Auditory composite skills (reception, association, sequencing)	.8304
Visual skills composite (reception, association, sequencing)	.6339

Individually the Arithmetic subtest as well as the Digit Span subtest had high correlation to both the capability and the skill areas. Taken together, the variables of on-task concentration and short term memory produce the attention-ability variable. The following table indicates the relationship of attention-ability to the three capability areas and the two undergirding skills area.

TABLE 5

Correlation of variable Attention-ability (on-task concentration + short term memory) with (1) Capabilities and (2) Undergirding skills.

Attention-ability	r value
Conceptual age (verbal comprehension)	.8708
Spatial organizing ability age	.7646
Sequencing organizing ability age	.9380
Auditory skills composite (reception, association, sequencing)	.8080
Visual skills composite (reception, association, sequencing)	.6098

Having looked at the Capabilities and the Undergirding skills as an index to try to explain the ratio gains, and then viewing the

function of Attention-ability in terms of learning, the logical question is: "Can the significant critical variables which contributed to the gains in reading, arithmetic and spelling be surfaced?". To achieve this, a step-wise multiple correlation technique together with a step-wise multiple regression was used. The following resulted.

TABLE 6

Dependent variable entered	Related critical independent variables	Multiple R
Reading grade level gains	Visual reception Digit Span (short term memory) Attention-ability	.8178
Arithmetic grade level gains	Visual association Sequential organizing ability age Coding	.9755
Spelling grade level gains	Performance I.Q. Picture completion Conceptual age (verbal comprehension) Grammatic closure	.9011
Length of time--Adler residence	Grammatic closure Visual sequential memory Information	.8247

R value = .788 @ .05
= .827 @ .01

DISCUSSION

(1) Children needing and utilizing mental health facilities services are frequently found to be deficient behaviorally and/or academically. Based on a study of the case histories of these children, it can be safely assumed that the improvement does not necessarily begin with the first day of full time residency. Also based on the individual

histories, improvement peaking had occurred just prior to discharge. The peaking would be manifest in behavioral and academic achievements. Children in a mental health facility program usually undergo an orientation period in which initially not too much change is noted. However, once the child has accepted the rationale and sees results based on operant conditioning, or behavior modification programs, a change of attitude and approach to learning is noted. This study indicates changes are related to achieved criterion levels. However the criterion level is not necessarily the full level of expectancy demanded when the child returns to the school in his community. The ratio gains indicated by this study seemingly show that the child having been exposed to and having been a part of a highly structured program will have gained a greater adaptability to grade level, grade expectations and behavioral expectations on his reentry into his community school.

The paired t tests to determine the significance of the means would indicate that the gains between the pre- and post tests to be highly significant. Because the gains are significant, the basic Capabilities, the Undergirding Skills, and the On-task Attention-ability can be meaningfully extracted. Having extracted these three factors, the logical question then becomes: Is there a consistent thread which could give an indication of the 'why' of the gains? The variable Attention-ability seems to have a high and consistent correlation to the basic Capabilities and the Undergirding Skills areas. Since the variable Attention-ability is the composite of the Arithmetic and Digit Span variables, the logical question then is: What is the relation of each variable to the Capabilities and Undergirding Skills areas? If the

Arithmetic subtest is viewed as an on-task concentration index and the Digit Span as a short term memory index, the correlations of the two basic areas academic pre-requisites is highly significant (Table 4).

(2) Since academics are measured in terms of reading, arithmetic and spelling, the results of the multiple correlations together with the multiple regression take on added meaning.

Table 6 would indicate that the reading grade level gains are logically explained by Visual Reception (understanding what is seen), the Digit Span (short term immediate memory) which becomes an intensive short learning period and that intensive short learning period is held constant by the variable Attention-ability and the process can be identified as a concentrated on-task application.

The arithmetic grade level gains are logically explained by the surfacing of Visual Association (visual associational memory), the Sequential Organizing Ability (ordering process) and the ability to transfer the symbol through a Coding process to a motor application (writing).

The spelling grade level gains also have a logical explanation in the four surfaced variables. The Performance IQ is an index of performing ability based on creating the whole from its parts. The Picture Completion variable deals with the ability to distinguish and separate the essential from non-essential details. These combined with the Conceptual (verbal and/or symbol comprehension) variable form a logical basic for the process and understanding of spelling. Grammatic Closure is a logical summation because Grammatic Closure permits facility and automatic usage of the words learned.

Question: For the length of time the children have participated

in the mental health facility school program, what resultants—if any--would emerge? Three significant variables, Grammatic Closure, Visual Sequential Memory and Information emerge. Grammatic Closure would indicate that the children have increased ability to communicate correctly automatically. There would be greater ease in the use of correct language which in turn means that the communication interactions are functioning with a higher index of efficiency and therefore there is an increase in the communicating skill together with a lessening of tension or frustration of not being understood correctly. The Visual Sequential Memory would indicate that the visual perceptual focusing ability has become more efficient and therefore what is perceptually seen is better understood in its context because of an easier flow of memory ordering and understanding. The third variable, Information, would indicate that the base of background information, the reservoir from which to draw on for communicating has been expanded. Taken together, these variables would indicate that the children are able to function at a higher level of communicating, have the ability to draw on a wider range of knowledgeability together with the capability of expressing themselves more comfortably while communicating.

(3) Carroll (1963) contended that if the student was given the amount of time he needed, and if he perservered, devoting the time to the learning task, he would reach criterion levels of achievement. Aptitude therefore, includes the amount of time needed to reach criterion. Therefore, it is logical that 1) the quality of instruction and 2) the student's ability to understand the instruction when both of these were optimal would make the time minimal for each student. And conversely, if the conditions were less than optimal, the amount of time

needed to reach criterion would be increased. Time becomes a central variable in school learning. Logically, the attainment of criterion is possible for all students who can be motivated to use time as they need it.

This study would indicate that under a mastery learning program, the amount of time and help needed decreases in sequential sets of learning because of increase in efficiency of learning. It would seem that performance and the formative tests (on-going and spot testing) should increase on successive learning units in a series. It would appear that the extra time and help in the early learning units contribute to the students' better motivation and improved cognitive entry behaviors (pre-requisite learning) for later learning units. What is being contended here is that a particular amount of time and help at an early stage in the learning sequence has a different effect than an equal amount of time and help at a later stage of a learning sequence. Hypothesis: Equal amounts of time and help do not have equal results on learning at all stages in the learning process.

Carroll (1963) in his model of school learning differentiates between lapsed time and "the time the learner is actually spending on the act of learning." That is "the time during which the person is oriented to the learning task and actively engaged in learning . . . is a time during which he (the learner) is 'paying attention and trying to learn' . . . the concept here is time on-task." Bloom (1973) in his study had found that the amount of time the student has to spend directly on learning (either covert or overt) is highly predictive of the learning achievement of the student. The (Bloom) correlation when corrected for reliability accounts for three-fifths of the achievement

variations of students.

CONCLUSION

Results of this study indicate that the ratio gains (the time rate of change) are based on a timed factor and therefore the biforcated variable of Attention-ability (on-task concentration and short term memory) take on added meaning. The on-task time would seem to be a powerful underlying variable in learning. If the above rationale is both logical and correct then the three factors of 1) time on-task, 2) on-task concentration and 3) short term memory would seem to be the basic components for criteria mastery learning. Mastery learning of itself is an end product. In this study the approach to the achievement of the end product of mastery learning exceeds the expected 1:1 level significantly. A logical conclusion: a mastery learning program for the academically and/or behaviorally deficient child should have as its goals, to expose, program and help the individual child motivate himself to learn how to learn and in so doing, internalize and use time on-task concentration more efficiently. Criterion attainment is possible for all students who can be motivated to use time as they need it.

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